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New Species of *Alyssum*, *Aphragmus*, *Arabis*, and *Sinosophiopsis* (Brassicaceae) from China and India

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ABSTRACT. The new species *Alyssum klimesii* and *Aphragmus ladakiana* from Ladak (northwestern India), *Arabis setosifolia* from Xizang (China), and *Sinosophiopsis furcata* from Sichuan (China) are described, and their relationships to the most closely related species of their respective genera are discussed.

Key words: *Alyssum*, *Aphragmus*, *Arabis*, Brassicaceae, China, India, *Sinosophiopsis*.

The following four new species are based on material collected from Ladak (India) by Leos Klimeš (Institute of Botany, Section of Plant Ecology, Třeboň, Czech Republic) and on Chinese herbarium specimens at KUN examined during my visit in August 2001. The paper represents part of the author's ongoing research on the Brassicaceae of the Himalayan flora.

Alyssum klimesii Al-Shehbaz, sp. nov. TYPE: NW India. Ladak: Rupshu, Lapgo River Valley, 5600 m, 32°59'N, 78°28'E, 12–13 July 2000, *Leos Klimeš s.n.* (holotype, MO #5317019).

Herba perennis, subpulvinata, tomentosa, canescens, pilis subdendriticis, longe stipitatis. Folia dense rosulata, persistentia, carnosa, sessilia, obovata vel spathulata, 3–10 × 1–2 mm, dense tomentosa. Racemi 2–4-flori, ebracteati. Petala rosea vel alba cum unguibus roseis, spathulata, 2–3 × 0.8–1 mm. Ovula 4, subapiculata. Siliculae ovoideae, inflatae, dense tomentosae, 2–3 × 1.5–2 mm, apice acuto-acuminatae; stylus 0.5–0.8 mm longus. Semina oblonga, 1.2–1.5 × 0.4–0.5 mm.

Herbs perennial, somewhat pulvinate, 1–3 cm tall, silvery canescent and tomentose throughout;

trichomes long-stalked, subdendritic, with finely branched rays. Stems much abbreviated, distinct and leafless sometimes in infructescence, terminating caudex branches. Leaves grouped in compact rosettes, persistent, fleshy, sessile; leaf blade obovate to spatulate, 3–10 × 1–2 mm, uniformly densely tomentose on both surfaces, base attenuate, apex obtuse. Raceme 2–4-flowered; peduncle distinct and fruits borne to 1 cm above leaf rosette, sometimes obsolete and fruits hardly exserted above rosette. Fruiting pedicels ascending, 0.5–2 mm long, slender, densely tomentose all around. Sepals oblong, 1.5–2 × 1–1.5 mm, persistent, stellate. Petals pink throughout or white with pink claws, spatulate, 2–3 × 0.8–1 mm, glabrous outside, caducous, apex rounded; claw pink, not papillate at base. Filaments 1.5–2 mm long, dilated and glabrous at base, neither winged nor appendaged; anthers ovate, 0.2–0.4 mm long. Ovules 4 per ovary, subapical, pendulous on long funicles. Fruit ovoid, 2–3 × 1.5–2 mm; valves not veined, inflated, densely tomentose outside, glabrous inside, base rounded, apex acute-acuminate; style 0.5–0.8 mm long, slender, glabrous, pink, exserted. Seeds oblong, 1.2–1.5 × 0.4–0.5 mm; cotyledons obliquely accumbent.

Alyssum klimesii is named in honor of Leos Klimeš, collector of the holotype who is conducting ecological studies in the alpine areas of Ladak (India). The species is most closely related to *A. canescens* DC. of China, Kashmir, Kazakstan, Mongolia, and Russia (Cheo et al., 2001). They resemble each other in being pulvinate, canescent

perennials and in having fleshy leaves and similar flower, fruit, and seed size. *Alyssum klimesii* is easily distinguished by having long-stalked subdendritic trichomes, fruiting pedicels 0.5–2 mm long, persistent sepals, spatulate petals 0.8–1 mm wide, glabrous bases of petal claws and staminal filaments, and inflated, ovoid fruits. By contrast, *A. canescens* has subsessile or short-stalked stellate trichomes, fruiting pedicels (3–)4–7 mm long, deciduous sepals, obovate petals 1.5–2.5(–3) mm wide, papillate bases of claws and filaments, and slightly flattened fruits.

In the Chinese paratypes listed below, the petals have white blades and pinkish claws much like those of *A. canescens*. However, in the collections from Ladak the petals are pink throughout. Because of the limited number of collections examined, it is not possible to determine whether or not such a difference merits taxonomic recognition.

Because of its pulvinate habit, canescent, densely tomentose leaves, and few-seeded ovoid fruits, one might confuse *Alyssum klimesii* with some species of *Draba*. However, none of the Himalayan species of *Draba* has ovaries with 4 subapical ovules pendulous on long funicles, pink petals or petal claws, and fruit valves as densely tomentose as the rest of the plant, whereas many species of *Alyssum* have the very same combination of characters.

Paratypes. CHINA. **Xizang (Tibet):** Zhongba Xian, Longgeqi, *Qinghai-Tibet Team 6591* (KUN, PE). NW INDIA. **Ladak:** Rupshu, ca. 5800 m, 33°10'N, 78°12.5'E, 9 July 2000, *Leos Klimesš s.n.* (MO); Rupshu, Kamdar La, 5700 m, 33°10.5'N, 78°14'E, 9 July 2000, *Leos Klimesš s.n.* (MO); Rupshu, ca. 5900 m, 32°59'N, 78°29.5'E, 14 July 2000, *Leos Klimesš s.n.* (MO).

Aphragmus ladakiana Al-Shehbaz, sp. nov.
TYPE: NW India. Ladak: Rupshu, Parang Valley, 4860 m, 32°30'N, 78°06'E, 25 July 2000, *Leos Klimesš s.n.* (holotype, MO # 5317023).

Herba perennis, 1–3 cm alta, puberula, pilis simplicibus usque 0.5 mm longis. Folia basalia rosulata, subcarnosa, oblanceolata, 5–12 × 1.5–2 mm, integra, retrorse puberula. Racemi 3–6-flori, corymbosi, ebracteati. Petala alba, late spatulata, 2.5–3 × 0.7–0.9 mm. Ovula 28–32. Siliquae lineares, teretes, 15–17 × 1–1.2 mm, laeves; gynophorum 0.2–0.7 mm longum; stylus 0.5–0.8 mm longus; septum longitudinaliter secedens. Semina oblonga, uniseriata, 0.6–0.8 × 0.3–0.4 mm.

Herbs perennial, 1–3 cm tall; caudex few-branched. Stems erect, simple, puberulent with simple trichomes to 0.5 mm long. Basal leaves rosulate, subfleshy; petiole-like base not expanded; leaf blade oblanceolate, 5–12 × 1.5–2 mm, retrorsely puberulent, base attenuate, margin entire,

apex obtuse. Cauline leaves absent. Racemes 3–6-flowered, corymbose, ebracteate, slightly elongated in fruit. Fruiting pedicels ascending, 2–3 mm long, puberulent all around. Sepals 1.5–2 × ca. 0.6 mm, puberulent. Petals white, broadly spatulate, 2.5–3 × 0.7–0.9 mm, apex rounded. Filaments 1–1.5 mm long; anthers oblong, ca. 0.5 mm long. Ovules 28 to 32 per locule. Fruit linear, 15–17 × 1–1.2 mm, terete, smooth; valves distinctly veined along proximal half, glabrous; gynophore 0.2–0.7 mm long; septum split longitudinally, hyaline; style 0.5–0.8 mm long; stigma entire. Seeds yellow-brown, oblong, uniseriate, 0.6–0.8 × 0.3–0.4 mm. Cotyledons incumbent.

Aphragmus ladakiana is closely related to *A. obscurus* (Dunn) O. E. Schulz, a species restricted to Sonamarg, Kashmir (Al-Shehbaz, 2000a). From that species, *A. ladakiana* is easily distinguished by having a distinct caudex, leafless stems, smooth fruits, hyaline septum split longitudinally, 28- to 32-ovuled ovaries, ebracteate racemes, fruiting pedicels puberulent all around, and smaller seeds 0.6–0.8 × 0.3–0.4 mm. *Aphragmus obscurus* has slender rhizomes, leafy stems, torulose fruits, no septum, 5- to 10-ovuled ovaries, fully bracteate racemes, adaxially puberulent and abaxially glabrous fruiting pedicels, and seeds 1.2–1.5 × 0.7–0.8 mm. With the discovery of *A. ladakiana*, *Aphragmus* now includes six species, the previous five of which are dealt with by Al-Shehbaz (2000a).

Paratype. NW INDIA. **Ladak:** Rupshu, ca. 5800 m, 32°43'N, 77°55.5'E, 31 July 2000, *Leos Klimesš s.n.* (MO).

Arabis setosifolia Al-Shehbaz, sp. nov. TYPE: China. Tibet (Xizang): Chaya Xian, Jitang, rocky roadside, 3700 m, 13 July 1976, *Qinghai-Tibet Team 12388* (holotype, KUN; isotype, KUN). Figure 1.

Herba perennis scaposa, 4–7 cm alta. Caules, pedicelli et sepala puberula, pilis furcatis brevi-stipitatis, 0.1–0.4 mm longis. Folia basalia rosulata, oblanceolata, 2–3.5 cm × 3–6.5 mm, pilis simplicibus setosis usque 1.5 mm longis. Folia caulina carentia vel unum. Racemi ebracteati. Sepala 2.5–3 mm longa. Petala rosea, oblanceolata, 5–6 × 2–2.5 mm. Ovula 11–14. Siliquae lineares, compressae, 1.8–2.3 cm × 1–1.2 mm, glabrae; stylus usque 0.3 mm longus. Semina oblonga 1.3–1.5 × ca. 0.7 mm, uniseriata.

Scapose perennial herbs 4–7 cm tall, without leaf remains of previous years. Trichomes on stems, pedicels, and sepals short-stalked, forked, 0.1–0.4 mm long. Stems erect, puberulent. Basal leaves rosulate, oblanceolate, 2–3.5 cm × 3–6.5 mm, setose with simple trichomes to 1.5 mm long, base attenuate, margin entire, apex obtuse. Cauline leaf 1 or

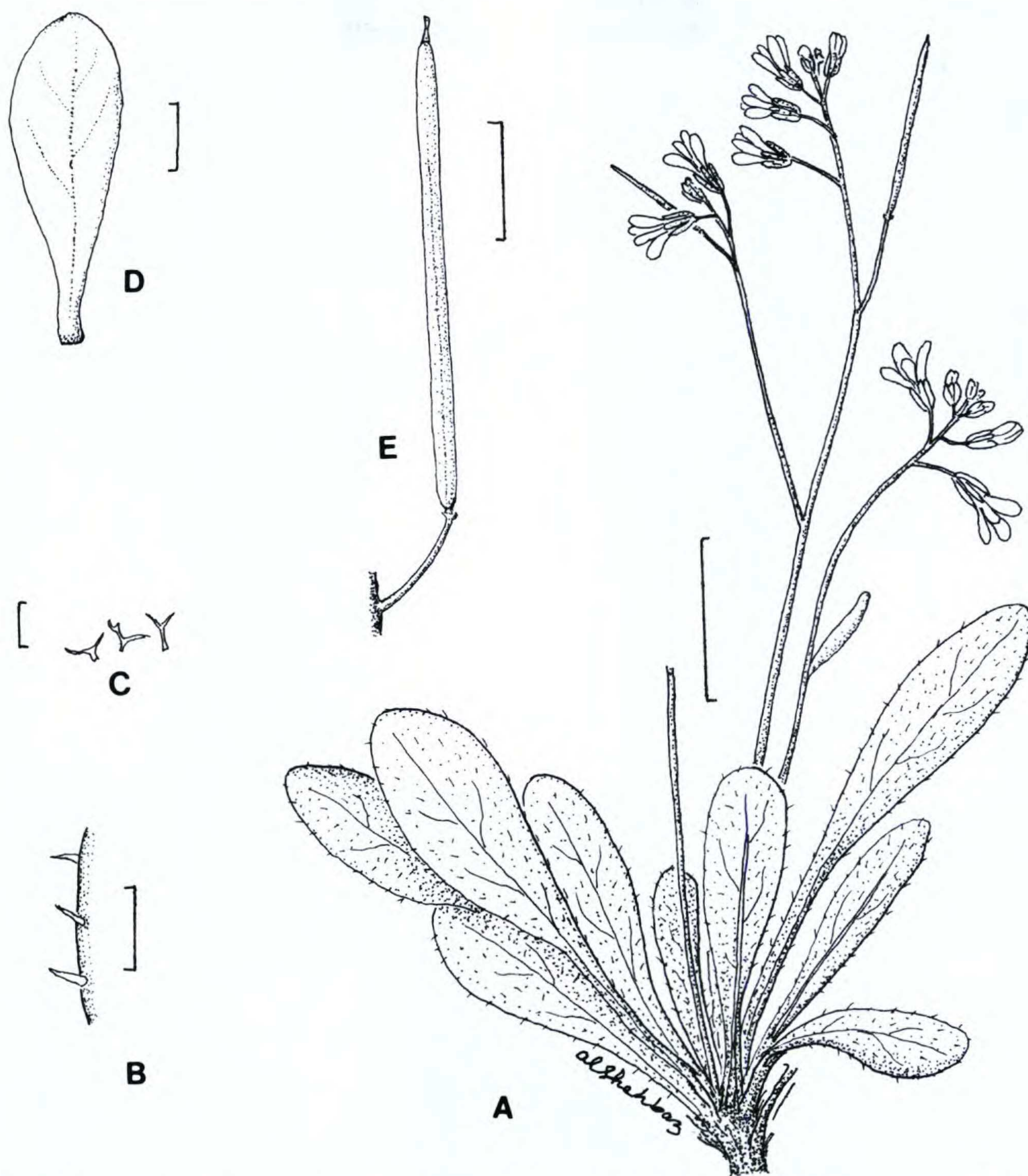


Figure 1. *Arabis setosifolia* Al-Shehbaz. —A. Plant. —B. Portion of leaf margin with setose trichomes. —C. Trichomes of stems and pedicels. —D. Petal. —E. Fruit and fruiting pedicel. Scale: A = 1 cm; B, E = 5 mm; C = 0.2 mm; D = 1 mm. Drawn by Al-Shehbaz: A–D from the holotype, Qinghai-Tibet Team 12388 (KUN); F from the paratype, Yan Jinsheng 91-492 (KUN).

absent, oblong, sessile, not auriculate, $7\text{--}13 \times 1\text{--}2$ mm. Raceme ebracteate. Fruiting pedicels $3.5\text{--}7$ mm long, ascending, densely puberulent, straight or curved upward. Sepals oblong, $2.5\text{--}3 \times \text{ca. } 1.5$ mm, purple tinged, sparsely puberulent to subglabrous, base not saccate, margin membranous. Petals pink, oblanceolate, $5\text{--}6 \times 2\text{--}2.5$ mm, obtuse, undifferentiated into blade and claw. Filaments $2.5\text{--}3$ mm long; anthers ovate-oblong, ca. 0.7 mm long. Ovules 11 to 14 per locule. Fruits linear, compressed, $1.8\text{--}2.3 \text{ cm} \times 1\text{--}1.2$ mm; valves glabrous, with a prominent midvein extending full length;

style obsolete or minute and to 0.3 mm long. Seeds oblong, $1.3\text{--}1.5 \times \text{ca. } 0.7$ mm, uniseriate, oblong; cotyledons accumbent.

Of the 14 species of *Arabis* L. recognized by Cheo et al. (2001) in China, none has a combination of setose basal leaves, puberulent stems and pedicels with minutely forked trichomes, stems only $3.5\text{--}7$ cm tall, and wingless seeds. The Chinese endemic *A. alaschanica* Maximowicz (Gansu, Nei Mongol, Ningxia, Qinghai, Shanxi, and Sichuan Provinces) also has setose basal leaves, but these

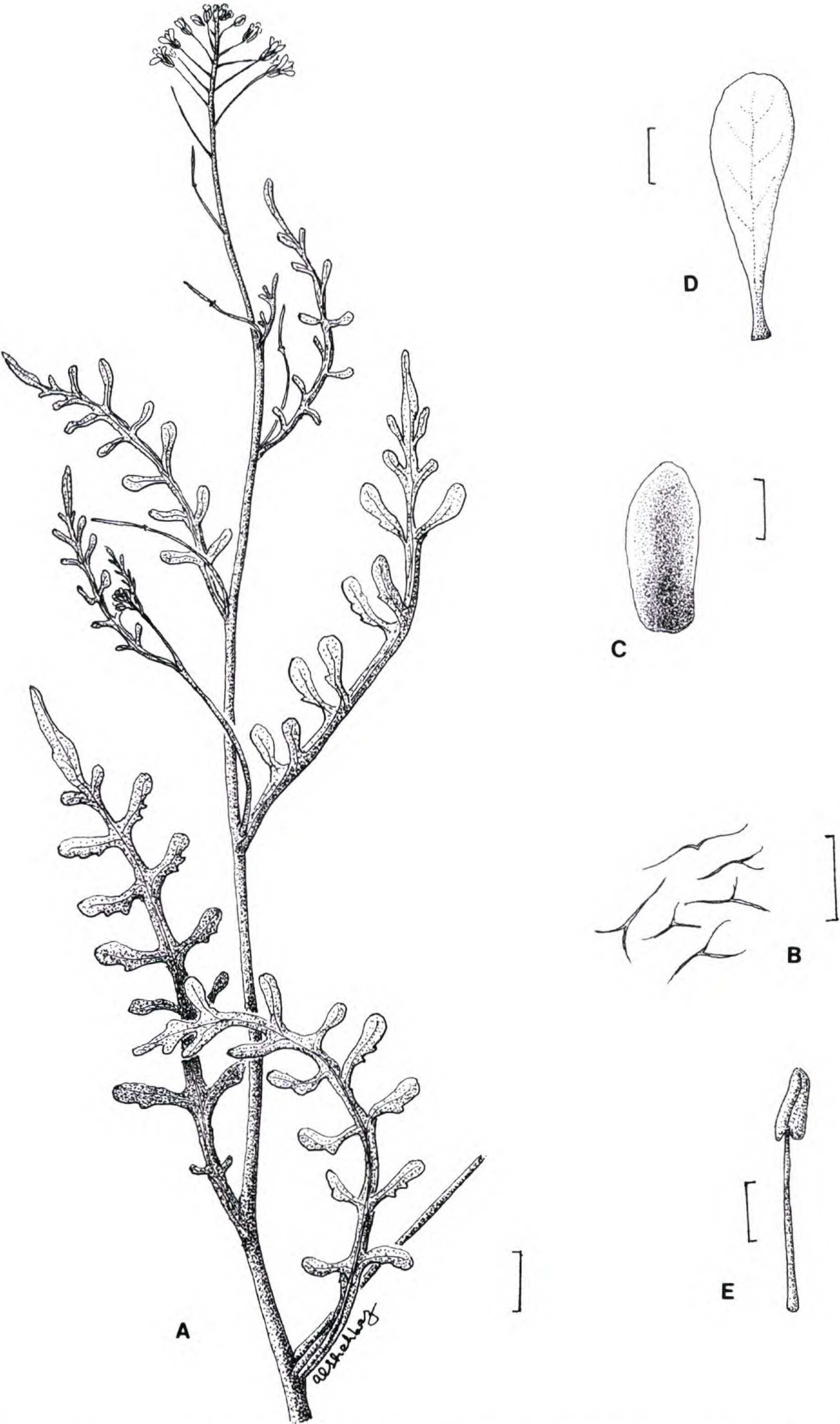


Figure 2. *Sinosophiopsis furcata* Al-Shehbaz. —A. Portion of plant. —B. Leaf trichomes. —C. Sepal. —D. Petal. —E. Median stamen. Scale: A = 1 cm; B = 0.4 mm; C–E = 1 mm. Drawn by Al-Shehbaz from the holotype, *Jian Shu 5031* (KUN).

hairs are mixed with short-stalked forked ones. It also differs from *A. setosifolia* by having caudices covered with stramineous, persistent petioles of previous years, slender styles 1–3 mm long, and larger seeds ($1.4\text{--}2.5 \times 0.8\text{--}1.4$ mm) that are winged distally. *Arabis setosifolia* is probably most closely related to *A. saxicola* Edgeworth (Afghanistan, India, Kashmir, Pakistan), from which it differs by having erect, subappressed fruits and entire leaves hirsute on both surfaces with simple, sub-setose trichomes. *Arabis saxicola* has divaricate to divaricate-ascending fruits and serrulate basal leaves pubescent only abaxially with short-stalked, 4-rayed stellate trichomes, and glabrous adaxially or sparsely pubescent with stellate or forked trichomes.

Paratype. CHINA. **Tibet:** eastern part of Gongjue Xian, 3650 m, 30 June 1991, *Yan Jinsheng* 91-492 (KUN).

Sinosophiopsis furcata Al-Shehbaz, sp. nov.

TYPE: China. Sichuan: Kanding Xian, Sha De Qu Ma Ti, sunny dry areas near stream, 2700 m, 29 May 1961, *Jian Shu* 5031 (holotype, KUN). Figure 2.

Herba annua vel biennis, ultra 30 cm alta. Caules glabri. Folia basalia ignota; folia caulina pinnatisecta, lobis lateralibus 5–7 jugis, anguste oblongis, $0.7\text{--}1.5$ cm \times 1–3 mm, basis subdecurrentibus, pilis sessilis, furcatis et malpighiaceis praeditis. Pedicelli floriferi tenues, divaricato-adscendentes, 1.3–2 cm longi. Sepala 3–4 mm longa, glabra. Petala alba, spatulata, $4\text{--}5 \times$ ca. 2 mm. Siliquae et semina ignota.

Annual or biennial herbs, more than 30 cm tall, lower part unknown. Trichomes restricted to leaves and young stems, sessile, 2- or 3-forked, mixed with fewer malpighiaceae ones. Stems erect, glabrous. Cauline leaves pinnatisect; petiole 1–2.5 cm long, glabrous, grooved; lateral leaf lobes 5 to 7 on each side of midvein, narrowly oblong, $0.7\text{--}1.5$ cm \times 1–3 mm, base slightly decurrent, proximal margin often minutely 1- or 2-toothed, otherwise entire, apex subacute; terminal lobe longer than lateral, linear-lanceolate, sessile, decurrent with distal pair of lateral lobes. Raceme with only lowermost few flowers bracteate. Flowering pedicels slender, divaricate-ascending, glabrous or sparsely pilose, 1.3–2 cm long. Sepals oblong, $3\text{--}4 \times$ ca. 1.5 mm,

erect, glabrous, base nonsaccate. Petals white, spatulate, $4\text{--}5 \times$ ca. 2 mm. Stamens strongly tetradynamous; median filaments ca. 3 mm long; lateral filaments ca. 1.5 mm long; anthers oblong, ca. 1.5 mm long. Pistil glabrous; style distinct; stigma capitate, entire. Fruits and seeds unknown.

Two species of *Sinosophiopsis* Al-Shehbaz were previously recognized (Al-Shehbaz, 2000b), and the Chinese-endemic genus is characterized by the annual or biennial habit, white flowers, nonsaccate sepals, branched trichomes, and pinnatisect leaves. *Sinosophiopsis furcata* is most closely related to *S. heishuiensis* (W. T. Wang) Al-Shehbaz, from which it differs by having sessile, forked trichomes mixed with fewer malpighiaceae ones, glabrous stems, 5 to 7 lateral leaf lobes on each side of midvein, sepals 3–4 mm long, and oblong anthers ca. 1.5 mm long. By contrast, *S. heishuiensis* has a mixture of simple and short-stalked forked trichomes, pilose stems, 2 to 4 lateral lobes on each side of midvein, smaller sepals 1.5–2.3 mm long, and ovate anthers 0.4–0.5 mm long. Both species are readily distinguished from the third species of the genus, *S. bartholomewii* Al-Shehbaz, by having ebracteate racemes or only basally bracteate racemes, and much longer pedicels (0.7–2 cm long) and petals (4–5 mm long). This last species has fully bracteate racemes, and shorter pedicels (1–3(–4) mm long) and petals (2–2.5 mm long).

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